Mitsuko SUGIYAMA*:

Comparative studies of vascular system of node-leaf continuum in the Ranalian complex (2) *Sargentodoxa cuneata* Rehd. & Wils.**

杉山明子:

キンポウゲ目及び類縁植物群の茎から葉への維管束系 (2) *Sargentodoxa cuneata* Rehd. & Wils. について

(Pl. X)

The genus *Sargentodoxa* is monotypic and a native of central China and Indo-China. This species was originally described by Oliver (1880) as one of the Lardizabalaceous plants but Rehder & Wilson (1913) separated it as an independent genus, and Staph (1925) established an independent family, Sargentodoxaceae.

The plant is a monoecious and deciduous vine with alternate leaves in two rows. The lowest leaves of long shoots are simple but others are mostly trifoliate. The only single observation on the vegetative anatomy has been so far reported (Henderson 1924). The present study deals with the vascular system in the node, petiole and through the midrib of lamina upto the very tip.

The material was obtained from Shanghai Botanical Garden, being collected in April 17, 1980. The young shoot, the latest one of the year, with two young leaves, was fixed with 50% Ethanol for a week and sent by airmail to the Koishikawa Botanical Garden, University of Tokyo. The treatment for the observed material was the same as described previously (Sugiyama 1979).

Observation The vascular system was observed in successive higher levels from the node to the tip of upper lamina of the compound leaves. The cauline vascular strands consisted of 10 to 12 descrete bundles, xylem inside and phloem outside (Fig. 1). The node showed the four trace, trilacunar (3:4) condition, and two leaf traces, M1 and M2, departed independently from the median lacuna (Figs. 1-3).

One or two bundles (bt') were observed between M1 and M2 in each in-

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* Musashino Women's College. 1-1-20 Shinmachi, Hoya-shi, Tokyo (202). 武蔵野女子大学生物研究室.

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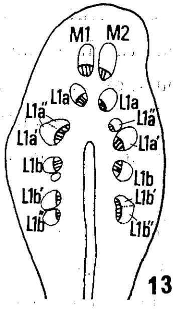

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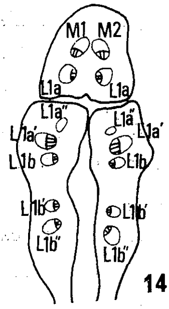

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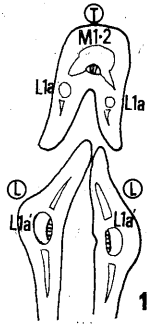

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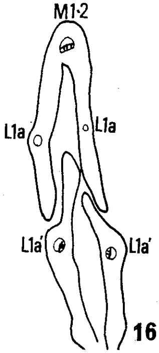

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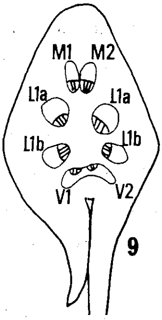

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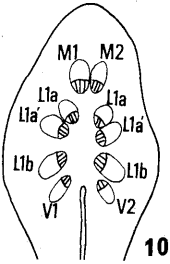

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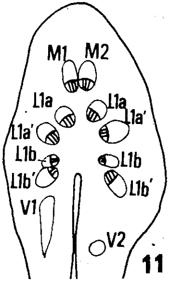

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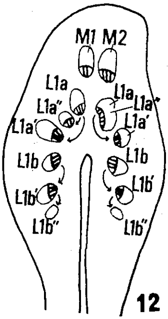

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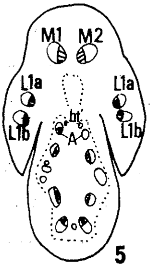

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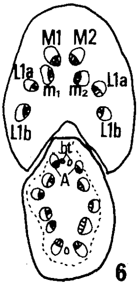

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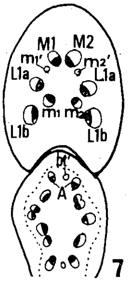

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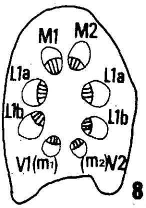

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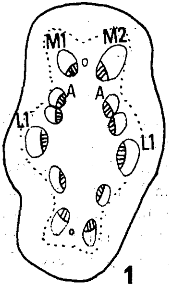

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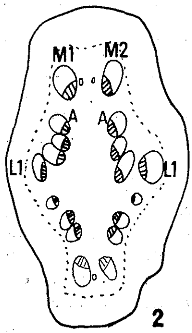

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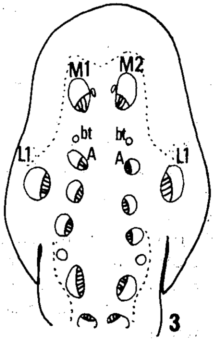

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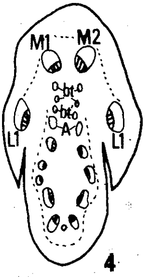

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ternode (Figs. 1, 2. Pl. X-4). These bt' bundles were diverged from cauline descrete A bundles of two nodes below as a part of axillary bud traces (bt) (Pl. X-3, 4). Most of bt bundles enter into axillary bud but the innermost two remained axile to form bt' bundles (Pl. X-3). The bt' bundles fused and appeared as a conspicuous single strand in the internode (Pl. X-4). The union of bt' bundle bifurcated again and each anastomosed with the double median bundles of the two nodes above (Figs. 1-3).

At the base of long petiole, two L1 bundles, one on each lateral side, and two median bundles, M1 and M2, in the center were situated (Fig. 4). In the lower petiole level, each L1 bundle bifurcated and gave rise to L1a bundle inside and L1b outside. Consequently, two median bundles (M1 and M2) and two pairs of lateral bundles (L1a and L1b) were observed (Fig. 5).

In the middle petiolar level, each median bundle gave off smaller bundle, thus, M1 sent off m1 and M2 sent off m2, respectively (Fig. 6). The offshoots, m1 and m2 bundles, as shifting adaxially and inverting in the xylem-phloem orientation bifurcated to give rise to further offshoots, m1′ and m2′ bundles. The m1′ and m2′ reshifted abaxially and fuse with larger median bundles: m1′ anastomose with M1 and m2′ with M2. The primary offshoots, m1 and m2 bundles, remaining adaxially formed two ventral bundles, V1 and V2 (Fig. 8). In the midrib of upper petiole V1 and V2 bundles anastomosed once but soon bifurcated in the successively higher level into the original V1 and V2 bundles (Figs. 9, 10). At this same level, the lateral L1a bundle on each side of two median bundles bifurcated to give rise to L1a′ bundle (Fig. 10).

At the base of trifoliate compound leaf, V1 and V2 bundles supplied the lower marginal vasculature of each lateral sessile pinna (Fig. 11). In the lamina base of compound leaf, the L1b bundle gave off L1b′ and then L1b″ successively. Likewise, the L1a bundle branched off L1a″ between the position of two lateral L1a and L1a′ bundles (Fig. 12). As a result, six bundles, L1a, L1a″, L1a′, L1b,

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Figs. 1-16. The vascular system in node-leaf continuum of *Sargentodoxa cuneata*. 1-2: at node, 3: at petiole base, 4-5: lower petiole, 6-8: successive levels in petiole, 9-13: successive levels in laminar base, 14-16: successive levels in lamina of compound leaf. 1-3: ca ×12, 4-7: ca ×7, 8-13: ca ×18, 14-16: ca ×14. Symbols. M1, M2: median trace. L1: lateral trace. L1a, L1b: lateral bundles derived with bifurcation of L1. m1, m2: diverged bundles from M1 or M2. m1′, m2′: branched bundles from m1 or m2. L1a′, L1b′: primary branches from L1a or L1b. Lba″: secondary branch from L1a. L1b″: branch from L1b′. M1·2: fused median bundle. A: cauline vascular strand which will convert into double median trace in upper leaf. bt: bud trace diverged from A. bt′: remained bud trace in axile derived from A but united to A in upper level. T: terminal pinna. L: lateral pinna.

L1b′ and L1b″, were situated on each side of double median bundle (Fig. 13).

In the lamina of compound leaf, the primary vascular system in the terminal and lateral pinnae was not identical. Each lateral pinna possessed a single centrally located larger bundle (L1a′) and laterally located several bundles (L1a″, L1b, L1b′ and L1b″) (Fig. 14). The terminal pinna possessed the double median bundle (M1 and M2) with lateral L1a bundle on each outer flank (Fig. 15). In the upper level of terminal pinna, the median M1 and M2 bundles fused to give rise to a large single M1·2 bundle which also served as the median bundle for the tip of terminal pinna (Figs. 15, 16).

Discussion Henderson (1924) reported the anatomy of node and internode of *Sargentodoxa cuneata* based on the fully developed stem by the hand-sectioned and macerated stem. Her illustration mostly agreed with the present observation except the recognition of small bundles placed between two median bundles, and she stated that these small bundles derived from the axillary bud and remained independently in the stele even at the nodal level. She considered that the small bundles were only referable to bud trace and the rest of axile strands to leaf traces, but she mentioned nothing about the nodal condition whether the trilacunar or the tetralacunar.

Later, Tayler (1967) used Henderson's illustration in his dissertation as reference for comparison with other genera of the Lardizabalaceae. He percieved the persistance of small bundles between two median bundles in considerable levels closer to the node (cf. Figs. 1-3). He said that the nodal condition was modified trilacunar node and where there were earlier, two gaps left by the two median traces, now consists of a single gap as the bud level is approached. He concluded that the similarity between these two families, the Sargentodoxaceae and Lardizabalaceae, would be only superficial, pointing out the characteristic double median bundle in the petiole of the former.

Although the small bundles (bt') between the two median bundles appeared conspicuously in the internode (Pl. X-4), the present observation shows that bt' are merely the residual branches of bud trace derived from the cauline descrete bundles (A) (Pls. X-1 to 4). These bt' bundles united in the neighbouring bundles, either M1 or M2, just before the two median bundles passed out to the petiole and degenerated at the node. As a result, the nodal condition of *Sargentodoxa cuneata* is the 4:3 type, and the median gap possesses two descrete leaf traces, M1 and M2. Though the double median bundle fused in the higher level of terminal pinna and formed a single M1·2 bundle, each retained independency of trace for the considerable distance in levels of internode, petiole and through the tip of the compound leaf (Figs. 1-15).

According to Marsden & Bailey (1955) and Bailey (1956), the unilacunar double trace node (2:1) would be the most primitive condition in dicotyledons. Similarly Takhtajan (1969) proposed the 4:3 type of node retaining double trace in the median gap as the most basic condition. If it was true in the consideration on the nodal phylogeny, *Sargentodoxa cuneata* would have possessed one of the most primitive type of node. In the mean time, the present author has drawn attention to the importance of the ventral bundle for discussion of phylogeny in the node-leaf vascular system of Magnoliales (Sugiyama 1979), and suggested that the basic nodal condition in dicotyledons seemed not to be the unilacunar but the multilacunar origin.

In discussing the nodal structure of the Sargentodoxaceae, the vascular system in the node-leaf continuum was more comparable to that of the Lardizabalaceae (Sugiyama, unpublished) than those families studied previously by the author (Sugiyama 1979, 1980), particularly in the mode of derivation as well as the behavior of adaxially located bundles at the petiole base. The ventral bundles of both in the Sargentodoxaceae and Lardizabalaceae diverged from the median bundles in the lower petiole (cf. Fig. 6), but these did not retain adaxial position in the midrib and became additional lateral bundles in the upper petiole (cf. Fig. 12).

The ventral bundle in the Magnoliaceae was derived by the similar manner as above mentioned two families being diverged from the median bundle shifting adaxially inverting in the xylem-phloem orientation. However, its behavior in the former two families differed from that of the Magnoliaceae since the ventral bundle in the latter remained adaxial position in successively higher levels of the laminar midrib never being transferred laterally even in the uppermost level (Sugiyama 1979). The Sargentodoxaceae showed closer similarity to the Lardizabalaceae regarding the behavior and the mode of derivation of the ventral bundle.

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Explanation of Plate X

Photographs of transection of *Sargentodoxa cuneata* showing vascular system from base upto middle level of petiole. 1: Petiole base. 2-3: Lower levels of petiole. 4: Middle level of petiole. Arrows indicate bt' bundles originated from two nodes below. Symbols. ab: axillary bud. Other symbols are shownin figures. All ca. ×26.

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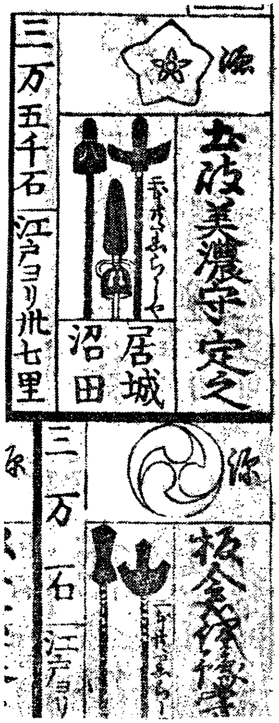
Sargentodoxa cuneata で若い茎の葉身先端まで維管束走行を観察した。節は4:3型で中央の隙から太い2本の葉跡 (M1, M2) をだし，特徴的である。この2本にはさまって小さい維管束 (bt') が節間の中心柱にみえる。Henderson (1924) の図では，小さいが独立した維管束として節に残るように描かれており，枝跡に関係するものと説明している。今回のくわしい観察によりこの bt' は葉序が2列互生のため2つ下の節で中心柱の維管束Aから分枝し，節間では独立した維管束として2本のAの間にはさまって位置

した姿であることが明らかになった。Aは上の節では中央維管束 M1 又は M2 となり葉柄基部へ入るもので，bt’ も節間では1本だが節に近づくと二叉分枝しそれぞれが両側のAと合流して葉跡となる。従って，Henderson の説明のように枝跡と葉跡は別のものではなく，下の節で枝跡を分枝したものの残りが2つ上の節で葉跡となり，中央維管束として葉柄基部へ入ることがはっきりした。その結果として4:3型の節構造を示すものである。側行維管束 (L1) は葉柄で二叉分枝をして L1a, L1b となる。また中央維管束は M1 から m1 を，M2 から m2 を分枝する。m1 と m2 は向軸側へ移行し，他の維管束同様木部が互いに向いあうかたちで向軸維管束となる。この点ではモクレン科の向軸維管束と同じ行動を示す (Sugiyama 1979)。しかし Sargentodoxaceae ではこの m1 と m2 は向軸側にそのままとどまらずすぐに側方へ移行し，側行維管束の一員となり，さらに上方の葉身基部ではそのまま二次脈となる。この点がモクレン科などの向軸維管束の行動とはちがう特徴である。似たような向軸維管束 (V) の行動は *Clematis* や *Paeonia* でもみられた (Sugiyama 1980)。茎から葉にいたる向軸維管束の行動が近縁分類群に特徴的である例の1つといえる。

□木村有香：**経ケ峯の植物**　75-108 pp. 1980.　仙台市教育委員会編仙台市文化財調査報告 No. 22 経ヶ峯．木村有香氏らしいととのった報告で489種を挙げてある。仙台市の一部で南方系と裏日本系とが入りまざっている。一番最後のページにオヤリハグマの写真を示し，これの語源について一言述べてあるのは注目に値する。それは槍の一形に山形槍（サンギョウヤリ）というのがあって，それの穂かまたは鞘をかぶせた穂先の形に葉の三裂した槍形がそっくりなので，一般に云うような花穂の細いのがこれに似ているというよりも確実と思われる。それにこの仲間はカシワバ，クルマバ，モミジ，キッコウ，とみな葉形か葉序によって名がつけられていることも参考になると述べている。これは賛成である。ただハグマについては別に述べてない。図は永代節用無尽蔵（嘉永2年再版）に出ていた各地の大名の内の二つの槍の図を示した。その形がオヤリハグマの葉と似ている。右に示した図は木村博士から贈られたコピーの一部から借用した。同博士に深謝する。

(前川文夫)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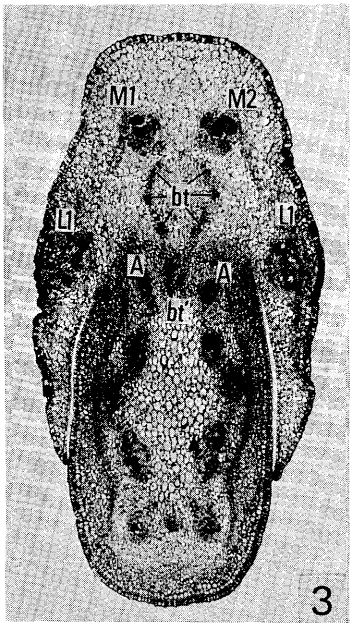

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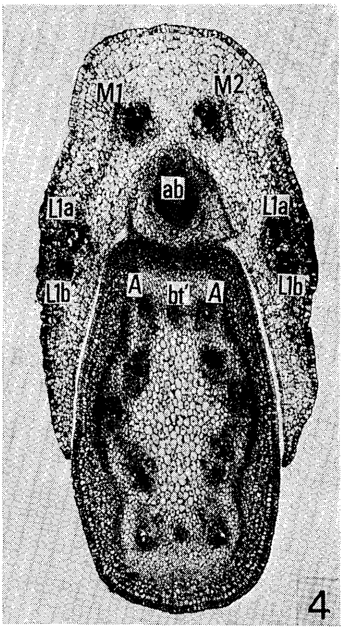

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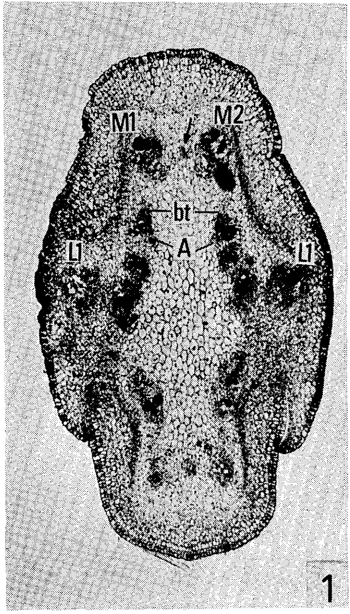

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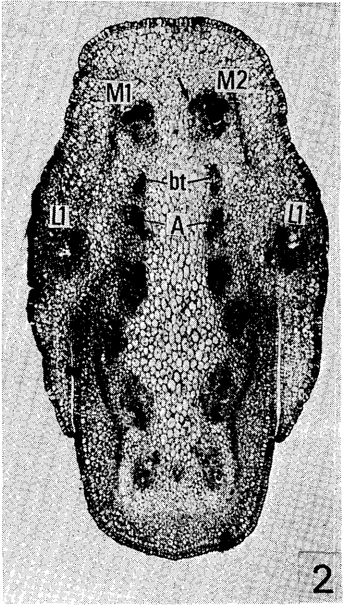

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M. SUGIYAMA: *Sargentodoxa cuneata*